

The Role of Vortices in the Formation of the Solar System

A. V. Mehta, G. R. Flierl (MIT)

To understand the role that vortices in the gaseous solar nebula disk played in the formation of grains from dust, three questions need to be answered: how would a large vortex form, what are the characteristics of a long-lived vortex, and how does such a vortex affect the flow of dust?

The shear due to the disk's Keplerian velocity profile significantly influences a vortex. Since this shear varies radially, the vortex characteristics must be studied numerically. A pseudo-spectral model has been developed to track numerically the evolution of a vorticity field in a simple, two-dimensional system by using the conservation of vorticity equation.

With initial conditions of random vorticity fields, which are representative of turbulence in the disk, fluid with negative vorticity (the same sign as the vorticity of the Keplerian shear) tend to merge to form a coherent vortex. The robust vortices have elliptical cross sections and can last without significant changes for 10^4 years. They are flattened radially, with their shape related to their size and their strength relative to the shear.

These vortices influence the flow of the dust grains which are suspended in the gas disk, tending to bring material into the negative vortex. The relative velocity of the particles is also affected, which then affects the particle collisions.

Division for Planetary Sciences Abstract Form

DPS Category 26

Running #7432

Session 0.00

Invited ☐ Poster presentation ☒ Title only ☐

Have you received your Ph.D. since the last DPS meeting?

Yes ☒ No ☐

Is your abstract newsworthy, and if so, would you be willing to prepare a news release and be available for interviews with reporters?

Yes ☐ No ☐ Maybe ☐

Paper presented by Anand Mehta

MIT Room 6-110
77 Massachusetts Ave.

Cambridge MA 02139 USA
Phone: 617-253-5342
Fax: none
Email: amehta@mit.edu

Special instructions: Expect PhD in December 1996, would like to make one-minute oral introduction of poster Tue Aug 27 16:05:34 CDT 1996

Membership Status (First Author):

DPS-AAS Member ☐ Non-Member ☐

Student Member ☐ Student Non-Member ☒

Is this your first DPS presentation? Yes ☒ No ☐

Sponsor: Timothy E. Dowling

Abstract submitted for 1996 DPS meeting

Date submitted: LPI electronic form version 5/96